REMARKS

Reconsideration of the rejection of the claims in this application is respectfully requested. By this amendment claims 1-3, 8, 11-13 have been amended. Currently, claims 1-15 are pending in this application. A Drawing Correction Authorization Request is being submitted concurrently herewith.

Objection to the drawings

The Examiner objected to the drawings and indicated that Figs. 1 and 3 should be designated by a legend such as "Prior Art". Applicants submit herewith a Drawing Correction Authorization Request in which the requested change to Figs. 1 and 3 has been made. The Examiner is thus respectfully requested to withdraw the objection to the drawings.

Objection to the claims

Claims 1-4, 8, and 11-12 were objected to because of several minor informalities. Applicants have amended the claims to overcome this objection and respectfully request that the objection to the claims be withdrawn.

Rejection of under 35 USC 112, second paragraph

Claims 4-5 and 9 were rejected under 35 USC 112, second paragraph, as indefinite. this rejection is respectfully traversed in view of the amendments to the claims and the following arguments.

With respect to claim 4, the Examiner indicated that claim 4 was indefinite because of the use of terms "small" and "advantageous". The Examiner indicated that the use of relative terminology would be acceptable if supported by the specification. In this instance, the specification at paragraph 39 states (emphasis added):

> Fig. 4 illustrates a process of selecting codes according to an embodiment of the invention. As shown in Fig. 4, initially, an ensemble of available codes with a given size permutation matrix are generated (100). Then, information vectors of weight 1 and 2 are encoded (102) and the ensemble of codes is reduced by discarding codes with a low minimum distance (104). The approximate upper bound for all of the remaining candidate codes is then calculated (106) and <u>a</u>

> small set of codes with the lowest bound under high signal to noise ratio is selected (108). The girth distributions for the remaining codes are then calculated (110) and the code that has the minimum number of short cycles is selected (112). The new code is then used to create another sub-matrix that is concatenated to the original π-rotation parity check matrix as shown in Fig. 2. This new π-rotation parity check matrix will have a code rate equal to x/x+1, where x is the number of sub-matrices that have been concatenated using this process. Where higher rate codes are desired, the process may iterate taking into account the parameters that have been determined during earlier iterations.

Thus, claim 4 is directed at step (108) which is illustrated for example in Fig. 4. A person of ordinary skill in the art could understand how to select a "small" set of codes. The example of the "lowest bound" is one example of an "advantageous characteristic". Thus, claim 4 is broader in this regard as it is not necessarily limited to selection of codes with lowest bounds. However, in view of the supporting description for the term "small" and "advantageous" in the specification, applicants respectfully submit that claim 4 is sufficiently definite and that the use of the objected-to terms does not render the claim indefinite. Accordingly, applicants respectfully request that the rejection of claim 4 be withdrawn.

Claim 5 was rejected for using the term "advantageous." Specifically, claim 5 recites that the "advantageous characteristics comprise a lowest bound characteristic." This is supported as described above in connection with claim 4. Accordingly, applicants respectfully request that the rejection of claim 5 be withdrawn.

Claim 9 was rejected as indefinite because of the use of the phrase "having good minimum distance." Claim 9 recites (emphasis added): "The method of claim 8, wherein the step of selecting the first matrix based on expansion properties of the first matrix comprises: *generating a plurality of matrices having good minimum distance profiles*; expanding the matrices to create a set of expanded matrices for a predetermined range; and selecting one of the matrices as the first matrix based on performance qualities of the corresponding expanded matrix." Paragraphs 32-38 of the specification as originally filed discuss ways to determine the minimum distance profiles of a matrix and describe what constitutes a "good" minimum distance profile. This term, although relative, is not indefinite since the specification provides a way for the term to be interpreted. See MPEP 2173.05(b) (A term of degree is acceptable where a standard for understanding the term is disclosed in the specification or where one of ordinary skill in the art would be apprised of the scope of the claim.) When read in the context of claims

1 and 8, and in view of the description in the specification, applicants respectfully submit that a person of ordinary skill in the art would understand that some matrices have good minimum distance profiles, while others have minimum distance profiles that are less advantageous. Thus, applicants respectfully submit that claim 9 is not improper under 35 USC 112, second paragraph, and respectfully request that the rejection of claim 9 be withdrawn.

Rejection of claims under 35 USC 101

Claims 1-10 were rejected under 35 USC 101 as directed to non-statutory subject matter. Specifically, the Examiner has taken the position that claim 1 recites an abstract idea through mathematical operations and, hence, is not patentable. Applicants have amended claim 1 to recite the step of storing the concatenated first matrix and π-rotation parity check matrix in a computer usable format, thus rendering the claim patentable under 35 USC 101. Accordingly the Examiner is respectfully requested to withdraw this rejection.

Claims 11-15 were also rejected under 35 USC 101 because of use of the term "configured". Specifically, the Examiner has taken the position that the use of the term "configured" renders the claim non-statutory because, according to the Examiner, the term "configured" makes the end result optional. Applicants respectfully disagree. A company that makes network elements will manufacture a network element that is configured to operate in a particular way on a computer network. When the network operator buys the network element, the network element is connected to the network and begins to transmit data in the manner in which it was configured by the company that made it. Thus, claim 11 was drafted to claim the network element both before and after the network element was connected to the network. Specifically, a network interface will be configured to transmit data by the company and will also be configured to transmit data once it is actually used. The end result is the configuration of the interface, not the fact that the interface is used to transmit data after it has been configured.

Claim 11 recites a network element that has a processor and at least one interface configured to engage in transmissions on a communication network. Claim 11 also includes control logic that creates a parity check matrix for use by the interface "for use by the interface to perform forward error correction on the transmissions on the communication network." This claim is statutory because the interface is configured differently than a normal interface. The tangible result is the way in which the interface is configured to handle communications on the

network. Regardless of whether the interface actually transmits any data, the interface has still been changed and, accordingly, a tangible result has been realized. Specifically, the interface itself has been changed. Thus, claim 11 recites a tangible result and, as such, is statutory. Accordingly, applicants respectfully request that the rejection of claims 11-15 be withdrawn.

Rejection of claims under 35 USC 103

Claims 1, 11, and 13-15 were rejected under USC 103 as unpatentable over Echart "*On the Construction of Some Deterministic Low-Density Parity Check Codes*," in view of Hocevar "*LDPC Code Construction with Flexible Hardware Implementation*." This rejection is respectfully traversed in view of the amendments to the claims and the following arguments.

Claim 1 recites the steps of: "creating a π-rotation parity check matrix having a first code rate; and concatenating a first matrix to the π-rotation parity check matrix to increase the first code rate." The π-rotation parity check matrix is described in the Specification at paragraphs 24. Specifically, applicants explain that the parity check matrix has the partitioned form $H = [H^p \mid H^d]$.

Applicants then explain in Paragraph 25 that the H^p sub-matrix in the π-rotation technique is a square, dual-diagonal matrix. A square dual-diagonal matrix has the form:

$$H^p = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

In paragraph 26, applicants state that the H^d sub-matrix includes four rotational orientations of the permutation matrix. Applicants then provide several examples and conclude, in paragraph 29, by showing a classic π-rotation parity check matrix $H = [H^p \mid H^d]$ having the form:

$$H = \begin{bmatrix} 1 & 1 & 0 & 0 & \pi_A & \pi_B & \pi_C & \pi_D \\ 0 & 1 & 1 & 0 & \pi_B & \pi_C & \pi_D & \pi_A \\ & \cdot & \cdot\cdot\cdot\cdot & & \pi_C & \pi_D & \pi_A & \pi_B \\ 0 & 0 & 0 & 1 & \pi_D & \pi_A & \pi_B & \pi_C \end{bmatrix}$$

Thus, the matrix H shown in Fig. 29 of the Specification and (and which is shown in Fig. 5.1 of Echard) is not a matrix concatenated with the π-rotation parity check matrix but rather is the π-rotation parity check matrix.

The Examiner has taken the position that Echard teaches concatenating a first matrix to the π-rotation parity check matrix, citing Fig. 5.1 and pages 74-75 of Echard. Applicants respectfully submit that Echard, in these two pages, rather teaches how to form each of the partitioned portions of the parity check matrix using the same process described above. Specifically, at pages 72-75 Echard teaches how to derive the matrix shown in Fig. 5.1. A review of this matrix indicates that it is identical to the π-rotation parity check matrix shown by applicants in Paragraph 29.[1] Accordingly, Fig. 5.1 of Echard does not show the steps of creating a π-rotation parity check matrix H and then concatenating a first matrix to the π-rotation parity check matrix. Rather, Fig. 5.1 of Echard simply shows a process of creating the π-rotation parity check matrix H. No matrix is concatenated to the π-rotation parity check matrix H.

The Examiner has not contended that Hocevar teaches concatenating a matrix to the π-rotation parity check matrix H of Echard. Rather the Examiner has taken the position that Hocevar teaches a way to construct low-density parity-check codes (LDPC) codes with a variety of code rates. The specific method taught by Hocevar is summarized in the last few sentences of Col. 2. For convenience, that portion of Hocevar is repeated below:

> A very rough description of our approach follows. Choose the parameters needed that will work for your problem, optimize the degree distributions, construct a matrix of dimension *jxk* that is populated largely with 0's and sparsely with 1's such that it closely matches the desired distributions, and lastly, replace each 0 with an *mxm* matrix of zeros and replace each 1 with the corresponding SFT circularly shifted permutation matrix for that position. The result is your parity check matrix.

Thus, as seen in this paragraph, Hocevar relies on an initial selection of a sparsely populated matrix and then uses the SFT process (described by Sridhara, Fuja and Tanner) to replace the 1s in the matrix with SFT permutation matrices. Hocevar goes on to state, in column 1 of page 2709, that "the step for constructing the *jxk* matrix of 1's and 0's is largely an art at this point, though we do have patterns that have worked well and that have further advantages in the

[1] Note that paragraphs 24-29 of the Specification are directed to explaining the π-rotation parity check matrix described in Echard. Thus, it makes sense that Echard teaches some of the same material as is also described in the specification.

architecture." Thus, Hocevar's system does not rely on concatenation of matrixes to the π-rotation parity check matrix H, but rather relies on a clever selection of a jxk matrix, and then the use of the SFT permutation matrix to create the LDPC code.

Hocevar therefore does not make up the deficiencies noted above with respect to Echard, since Hocevar like Echard does not teach or suggest concatenating a first matrix to the π-rotation parity check matrix H. Accordingly, applicants respectfully submit that the combination of Echard and Hocevar fails to teach claim 1 as currently drafted and respectfully request that the rejection of claim 1 be withdrawn.

Similarly, the combination of Echard and Hocevar fails to teach or suggest control logic configured to create a parity check matrix for use by the interface to perform forward error correction on the transmissions on the communication network, the parity check matrix comprising a π-rotation parity check matrix having a first code rate; and a first matrix concatenated to the π-rotation parity check matrix to increase the first code rate of the π-rotation parity check matrix as recited in claim 11. Accordingly, applicants respectfully request that the rejection of claims 11 and 13-15 be withdrawn.

Conclusion

Applicant respectfully submits that the claims pending in this application are in condition for allowance and respectfully requests an action to that effect. If the Examiner believes a telephone interview would further prosecution of this application, the Examiner is respectfully requested to contact the undersigned at the number indicated below.

If any fees are due in connection with this filing, the Commissioner is hereby authorized to charge payment of the fees associated with this communication or credit any overpayment to Deposit Account No. 502246 (Ref: NN-16811).

Respectfully Submitted,

John C. Gorecki, Reg. No. 38,471

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John C. Gorecki, Esq.
P.O. Box 553
Carlisle, MA 01741
Tel: (978) 371-3218
Fax: (978) 371-3219
john@gorecki.us